AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Patent Application No. 09/762,233

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the said electrodes at their intersection points, the said cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying scanning voltages to ~~the~~ selected scanning electrodes, and applying a reference voltage ~~(V_o-level)~~ level V_o to ~~the~~ non-selected scanning electrodes;

applying to a signal electrode, during a selection period, a basic voltage level or levels ~~consisting of a level or levels unequal to V_o level or/and of V_o level to a signal electrode~~ unequal to or approximately equal to the reference voltage level V_o for obtaining current values of brightness of a selected display element or of a group of selected display elements; ~~the distinguishing step of:~~ and

applying to the signal electrode, during the selection period, two additional voltage levels having different polarities with respect to the reference voltage level V_o, the same constant modules of deviation from ~~V_o level~~ the reference voltage level V_o, and constant and equal duration ~~to the signal electrode~~.

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2. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the said electrodes at their intersection points, the said cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying scanning voltages to the selected scanning electrodes, and applying a reference voltage ~~(V_e-level)~~ level V_o to the non-selected scanning electrodes;

applying to a signal electrode, during a selection period ~~(T_r)~~ T_r, a basic voltage level or levels ~~consisting of a level or levels unequal to V_e-level or/and of V_e-level to a signal electrode~~ unequal to or approximately equal to the reference voltage level V_o for obtaining current values of brightness of a selected display element or of a group of selected display elements; ~~the distinguishing steps of:~~

applying to the signal electrode, during the selection period T_r, ~~two additional~~ first and second voltage levels having different polarities with respect to the reference voltage level V_o, the same constant-modules ~~(V_m)~~ V_m of deviation from ~~V_e-level~~ the reference voltage level V_o, and constant and equal duration $t_m/2$ ~~($t_m/2$) to the signal electrode~~; and

applying to the signal electrode, during the selection period T_r after applying ~~a~~ the first voltage of ~~one~~ a first polarity ~~about V_e-level~~ and before applying ~~a~~ the second voltage of ~~other~~ a

~~second~~ polarity ~~about V_o level, the~~ a third ~~additional V_o voltage~~ voltage level ~~approximately~~ equal to the reference voltage level V_o having a constant duration t_o ~~(t_m) to the signal electrode~~.

3. (Currently Amended) The method of claim 2, wherein durations of the basic voltage levels ~~applying~~ applied to the signal electrode are varied for obtaining a particular current value of brightness of the selected display elements and are adjusted in such a way

that under one-line selection, during a period T_r, the sum duration of all basic voltage levels is equal to constant value ($T_r - t_m - t_o$) or,

that under multiple-line selection, during all periods of selection the same display elements in frame time, the averaged over the period T_r sum of products of duration of every basic voltage level unequal to the reference voltage V_o to square of inverted ratio of modulus of deviation of the ~~said~~ level from ~~V_o level~~ the reference voltage level V_o to modulus of deviation ~~(from V_o level)~~ the reference voltage level V_o of the basic level for the ~~said~~ display one-line selected by the ~~said~~ method ~~(with~~ with the same values $t_m/2$ and V_m of the ~~said pair of additional~~ the first and second levels and with the same duration to of the ~~said~~ third ~~additional V_o level)~~ level is equal to constant value ($T_r - t_m - t_o$).

4. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the said electrodes at their

intersection points, the said cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying scanning voltages to the selected scanning electrodes, and applying a reference voltage ~~(V_o level)~~ level V_o to the non-selected scanning electrodes;

applying to a signal electrode, during a selection period ~~(T_s)~~ T_r, a basic voltage level or levels ~~consisting of a level or levels unequal to V_o level or/and of V_o level to a signal electrode~~ unequal to or approximately equal to the reference voltage level V_o for obtaining current values of brightness of a selected display element or of a group of selected display elements; ~~the distinguishing steps of:~~

applying, during the period T_r, ~~two additional~~ first and second voltage levels having different polarities, the same constant modules of deviation from ~~V_o level~~ the reference voltage level V_o, and constant and equal duration to the signal electrode, the ~~said~~ additional the first and second voltage levels being allocated to ~~the~~ boundary portions of the period T_r so that ~~one~~ the first level is allocated to ~~the~~ a beginning portion and the ~~other~~ second level is allocated to ~~the~~ an end portion of the period T_r;

applying, during the period T_r, voltage levels to the signal electrode in direct or in reverse order; and

alternating, in succeeding periods T_r, the ~~said~~ orders of applying of voltage levels to the signal electrode on the basis of changing of the polarity of the voltage deviation from ~~V_o level~~ the reference voltage level V_o in the beginning ~~(and, accordingly,~~ in the end) of the period T_r so

that the positive polarity ~~being~~ is set in the beginning of one period T_r and the negative polarity ~~being~~ is set in the beginning of the next period T_r.

5. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying scanning voltages to the selected scanning electrodes, and applying a reference voltage ~~(V_o-level)~~ level V_o to the non-selected scanning electrodes;

applying to a signal electrode, during a selection period ~~(T_r)~~ T_r, a basic voltage level or levels ~~consisting of a level or levels unequal to V_o-level or/and of V_o-level to a signal electrode~~ unequal to or approximately equal to the reference voltage level V_o for obtaining current values of brightness of a selected display element or of a group of selected display elements; ~~the distinguishing steps of:~~

applying, during the period T_r, ~~two~~-additional first and second voltage levels having different polarities, the same constant modules of deviation from ~~V_o-level~~ the reference voltage level V_o, and constant and equal duration to the signal electrode, the ~~said~~ additional the first and second voltage levels being allocated to ~~the~~ boundary portions of the period T_r so that ~~one~~ the

first level is allocated to ~~the~~ a beginning portion and the ~~other~~ second level is allocated to ~~the~~ an end portion of the period T_r;

applying, during the period T_r, voltage levels to the signal electrode in direct or in reverse order; and

applying, during the period T_r, voltage levels to adjacent signal electrodes or to signal electrodes located one or two electrodes further or to signal electrodes having another type of activation sequence so that the levels allocated to the beginning portion ~~(and, accordingly,~~ and to the end ~~portion)~~ portion of the period T_r have deviations of opposite polarities from ~~V_o level~~ the reference voltage level V_o.

6. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying scanning voltages ~~(V_r)~~ V_r to the selected scanning electrodes, and applying a reference voltage ~~(V_o level)~~ level V_o to the non-selected scanning electrodes;

applying to a signal electrode, during a selection period ~~(T_r)~~ T_r, a basic voltage level or levels ~~consisting of a level or levels unequal to V_o level or/and of V_o level to a signal electrode~~ unequal to or approximately equal to the reference voltage level V_o for obtaining current values

of brightness of a selected display element or of a group of selected display elements; ~~the distinguishing steps of:~~

applying, during the period T_r, ~~two~~ additional first and second voltage levels having different polarities, the same constant modules of deviation from ~~V_o level~~ the reference voltage level V_o, and constant and equal duration to the signal electrode, the ~~said~~ additional first and second voltage levels being allocated to ~~the~~ boundary portions of the period T_r so that ~~one~~ the first level is allocated to ~~the~~ a beginning portion and the ~~other~~ second level is allocated to ~~the~~ an end portion of the period T_r;

applying, during the period T_r, voltage levels to the signal electrode in direct or in reverse order; and

alternating, during periods T_r of selecting the same scanning electrode or the same group of scanning electrodes where the scanning voltages or the scanning voltage groups have identical or opposite polarities about ~~V_o level~~ the reference voltage level V_o, the ~~said~~ order of the applying the signal voltage levels to the signal electrode ~~(during~~ during the period ~~T_r)~~ T_r in succeeding frame time periods or in a frame time or in two frame time or in accord with other order of comparison in time by setting alternately the same and opposite directions of the deviation ~~(from V_o level)~~ from the reference voltage level V_o of the signal voltage level allocated to the beginning ~~(and, accordingly,~~ and to the end~~)~~ portion of the period T_r and of the deviation ~~(from V_o level)~~ from the reference voltage level V_o of the voltage V_r applied to the ~~said~~ same selected scanning electrode or to the same selected scanning electrode of the ~~said~~ same selected group.

7. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying scanning voltages to the selected scanning electrodes, and applying a reference voltage ~~(V_o-level)~~ level V_o to the non-selected scanning electrodes;

applying to a signal electrode, during a selection period ~~(T_r)~~ T_r, a basic voltage level or levels ~~consisting of a level or levels unequal to V_o level or/and of V_o level to a signal electrode~~ unequal to or approximately equal to the reference voltage level V_o for obtaining current values of brightness of a selected display element or of a group of selected display elements; ~~the distinguishing steps of:~~

applying, during the period T_r, ~~two~~ additional first and second voltage levels having different polarities, the same constant modules of deviation from ~~V_o level~~ the reference voltage level V_o, and constant and equal duration ~~(t_m/2)~~ $t_m/2$ to the signal electrode, the ~~said~~ additional first and second voltage levels being allocated to ~~the~~ boundary portions of the period T_r so that ~~one~~ the first level is allocated to ~~the~~ a beginning portion and the ~~other~~ second level is allocated to ~~the~~ an end portion of the period T_r;

applying, during the period T_r, voltage levels to the signal electrode in direct or in reverse order so that the order of their applying to the signal electrode is alternated in succeeding periods T_r; and

splitting the voltage pulses applied to signal electrodes into a number of groups being related to different electrodes and shifting the pulses in time concerning their nominal positions in the period T_r so that the values of shifting time are the same for the pulses of a single group, but are different for the pulses of different groups, and constant for certain period, after termination the ~~said~~ time period, other values of shifting time are set in certain or in all groups of voltage pulses or other aggregate of groups of voltage pulses is formed with different values of shifting time in various groups, and the other values of shifting time are set constant for the next time period, after termination of which the ~~said~~ process of either changing or setting constant values of shifting time are continued providing zero average deviation of duration of each said additional level from its nominal duration.

8. (Original) The method of claim 7, wherein modulus of shifting times of voltage pulses applied to a group of the signal electrodes are set in the range of values from zero to $t_m/2$.

9. (Original) The method of claim 7, wherein, after termination of the time period during which the shifting time values of groups of voltage pulses applied to the signal electrodes are kept constant, the latest shifting time value are set in the group of pulses, each having the earliest shifting time value, the previous shifting time value is set in the group of pulses, each

having the next after the earliest shifting time value, and such changing of shifting time values is applied in other groups up to group of pulses, each having the earliest shifting time value, which are changed to the latest shifting time value.

10. (Original) The method of claim 7, wherein a group of voltage pulses having the same shifting time is formed for a group of signal electrodes in such a way that each electrode is distant from other electrodes in the group.

11. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying scanning voltages to the selected scanning electrodes, and applying a reference voltage ~~(V_o-level)~~ level V_o to the non-selected scanning electrodes;

applying, during a selection period, pulses of voltage to a signal electrode, the ~~said~~ pulses setting a basic voltage level or levels ~~consisting of a level or levels unequal to V_o-level or/and of V_o-level~~ unequal to or approximately equal to the reference voltage level V_o, the ~~said~~ levels setting nominal values of mean square voltage on the selected cell or cells for obtaining current

values of brightness of a selected display element or of a group of selected display elements; ~~the distinguishing steps of:~~

applying, during the selection period, ~~two~~ additional first and second voltage levels having different polarities, the same constant modules of deviation from ~~V_o level~~ the reference voltage level V_o, and constant and equal duration to the signal electrode, the ~~said~~ additional first and second levels setting ~~practically~~ approximately constant ~~(in time)~~ deviations from the nominal values of mean square voltage on cells connected with the signal electrode, the ~~said~~ deviations being caused by distortions of a shape of the voltage pulses in process of their propagation along the signal electrode;

providing, during a frame time period, a single or several additional time intervals ~~(t_o)~~ t_c;

applying, during some mentioned single or several intervals t_c, compensative voltages $V_{com}(i)$ to each i-th scanning electrode, beginning with a certain electrode,

~~or/and~~ and during other mentioned single or several intervals t_c, applying compensative voltages V_{com} (j) to each j-th signal electrode, beginning with other certain electrode, the ~~said~~ voltages V_{com} (i) or/and, respectively, V_{com} (j) having values or/and durations specific to each electrode and giving the total or a partial compensation of the deviations of the mean square voltages on the ~~sells~~ cells of the i-th scanning electrode from their nominal values or/and, respectively, of the deviations of the mean square voltages on the ~~sells~~ cells of the j-th signal electrode from their nominal values, the ~~said~~ deviations initiated by the ~~said~~ distortions of shape of the signal voltage pulses in process of their propagation along the signal electrode, ~~or/and~~ and,

respectively, initiated by distortions of shape of the scanning voltage pulses in process of their propagation along the scanning electrode; and

applying, during the ~~mentioned~~ intervals t_c, the reference voltage or a quasireference voltage or a quasi-reference voltage on average or their combination to the scanning ~~or/and~~ and to the signal electrodes free from the ~~said~~ compensative voltages.

12. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying scanning voltages to the selected scanning electrodes, and applying a reference voltage ~~(V_0-level)~~ level V_0 to the non-selected scanning electrodes;

applying, during a selection period, pulses of voltage to a signal electrode, the pulses setting a basic voltage level or levels consisting of a level or levels ~~unequal to V_0-level or/and of V_0-level~~ unequal to or approximately equal to the reference voltage level V_0 ~~to a signal electrode~~, the ~~said~~ levels setting nominal values of mean square voltage on the selected cell or cells for obtaining current values of brightness of a selected display element or of a group of selected display elements; ~~the distinguishing steps of:~~

applying, during the selection period, ~~two~~ additional first and second voltage levels having different polarities, the same constant modules of deviation from ~~V_o level~~ the reference voltage level V_o, and constant and equal duration to the signal electrode, the ~~said~~ additional first and second levels setting practically constant ~~(in time)~~ deviations from the nominal values of mean square voltage on cells connected with the signal electrode, the ~~said~~ deviations being caused by distortions of a shape of the voltage pulses in process of their propagation along the signal electrode;

applying, during the selection periods, additional compensative voltages to selected scanning electrodes, beginning with a certain electrode, and superimposing the ~~said~~ compensative voltage on the scanning voltage, the ~~said~~ compensative voltage having value or/and duration specific to the selected scanning electrode and total or a partial compensating the deviations of the mean square voltages on the cells of the selected scanning electrode from their nominal values, the ~~said~~ deviations being caused by the ~~said~~ distortions of shape of the signal voltage pulses in process of their propagation along the signal electrode.

A4

13. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes in one-by-one or group-by-group sequence, applying pulses of scanning voltages to the selected scanning electrodes, and applying a reference voltage ~~(V_0-level)~~ level V_0 to the non-selected scanning electrodes;

applying pulses of voltage to a signal electrode, the ~~said~~ pulses setting basic voltage level or levels setting nominal values of mean square voltage on selected ~~sells~~ cells for obtaining nominal values of brightness of selected display elements; ~~the distinguishing step of:~~

forming voltage pulses in the shape providing total or partial self-compensation of spurious changes of the mean square voltages on the selected ~~sells~~ cells, the ~~said~~ changes initiated by distortions of fronts and tails of the pulses in process of their propagation along display ~~electrode~~ electrodes.

14. (Currently Amended) The method of claim 13, wherein the front of pulse is formed in stepwise shape ~~or in the shape similar to stepwise one~~.

15. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, comprising the steps of:

selecting scanning electrodes at least two times ~~or more times~~ a frame in sequence two by two, applying scanning voltages ~~(V_{s1} and V_{s2})~~ V_{r1} and V_{r2} to selected scanning electrodes, and

applying a reference voltage ~~(V_0-level)~~ level V_0 to the non-selected scanning electrodes, wherein polarities of deviation of the scanning voltages V_{r1} and V_{r2} from ~~V_0-level~~ ~~V_0-level~~ the reference voltage level V_0 are set either same or opposite order ~~(or in reverse order, or in mixed order)~~;

applying, during a selecting period ~~(T_r)~~ T_r, a basic voltage level or levels having ~~the~~ same modulus V_c of deviation from the reference voltage level V_0 ~~or/and of V_0-level~~ equal to the reference voltage level V_0 to a signal electrode for obtaining current values of brightness of selected display elements; ~~and the distinguishing step of:~~

forming the ~~said unequal to V_0-level~~ basic voltage levels having the same modulus V_c of deviation from the reference voltage level V_0 to be ~~being~~ composed of an information component and of quasi-reference equalizing components such

that the duration and the polarity of deviation from ~~V_0-level~~ the reference voltage level V_0 of the information component, during the period T_r of the applying the scanning voltages V_{r1} and V_{r2} with the same polarities of deviation from ~~V_0-level~~ the reference voltage level V_0, being set in ratio to the value of half sum of brightness of the selected display elements ~~(or~~ or with correction of the ratio taking into account an non-linearity of an electro-optic behavior of the display ~~element)~~ element,

that the duration and the polarity of deviation from ~~V_0-level~~ the reference voltage level V_0 of the information component, during the period T_r of the applying the scanning voltages V_{r1} and V_{r2} with opposite polarities of deviation from V_0-level, being set in ratio to the value of half difference between brightness of the selected display elements ~~(or~~ or with the ~~said~~ correction of the ratio taking into account the ~~said non-linearity)~~ non-linearity, and

that the common duration of the quasi-reference equalizing components being set, during any or both periods T_r in the frame of selecting the same display elements, to bring the common duration of all levels unequal to V_o ~~(for~~ for the ~~said~~ same selected display ~~elements)~~ elements to a constant value.

16. (Currently Amended) The method of claim 15 ~~including claim 1~~, wherein the ~~said~~ constant value of common duration of all signal voltages levels unequal to V_o and applied to the signal electrode for the same elements selected in both periods T_r of the frame, the levels including information component, equalizing component, and two additional levels with different polarities, constant modules of deviation from V_o-level equal to V_c, and constant and equal duration ~~(t_m/2)~~ $t_m/2$, the ~~said~~ additional levels set during every period T_r, is equal to ~~(T_r+t_m)~~ T_r+t_m.

17. (Currently Amended) A device for driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, the display driven by the method ~~variants of claims from 1 to 16 realized separately or in their combinations~~ of claim 1, comprising:

a voltage level generator ~~(or power supply block)~~ and a ~~bunch~~ plurality of voltage ~~pulsers~~ pulses for the display electrodes, each voltage ~~pulser~~ pulse containing a block setting timing

voltage levels to an output electrode, the output electrode, and an output transistor block connected with the output electrode, with the voltage level generator and with the block setting timing voltage levels connected with the voltage level generator, ~~characterized in that~~ wherein

the block setting timing voltage level to the output signal electrode contains technical means ~~to~~ for timing additional voltage levels of constant duration, applying to the signal electrode; and

the output transistor block is fixed in such a way that the output resistances for different voltage levels of the ~~said~~ block has the same values, or the deviation of values does not exceed 10%.

18. (Currently Amended) A method of driving a display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, having value of display parameter N_{max} greater or equal to number N_{maxo} where N_{maxo} is the minimum value of N_{max} of the display capable to correct driving by voltage waveforms in accordance with the method ~~variants of claims from 1 to 16, realized separately or in their combination~~ of claim 1, comprising the steps of:

selecting scanning electrodes in sequence one by one or group by group, applying scanning voltages ~~(V_r)~~ V_r to the selected scanning electrodes, and applying a reference voltage ~~(V_o level)~~ V_o to the non-selected scanning electrodes;

applying, during a selecting period, a basic voltage level or levels ~~(V_e)~~ V_c consisting of a level or levels unequal to ~~V_e level or/and of V_e level~~ the reference voltage level V_o or the reference voltage level V_c to a signal electrode for obtaining current values of brightness of a selected display element or of a group of selected display elements; ~~and the distinguishing steps of:~~

applying the voltages V_r about $|V_{ro}|\sqrt{1-\eta}$ to the scanning electrodes,

applying the voltages V_c about $|V_{co}|\sqrt{1+\eta}$ to the signal electrodes,

wherein $|V_{ro}|$ and $|V_{co}|$ are the modules of the voltages V_r and V_c applied to another ~~(reference)~~ display having the value of N_{max} equal to N_{maxo}, ~~the said other display driven correctly by the method of the mentioned claims,~~ and η is a number parameter for tailoring of the voltages V_r and V_c to the correct driving or close to the correct driving of the ~~said~~ display having N_{max} greater or equal to N_{maxo}.

19. (Currently Amended) A display having a panel including substrates having an array of scanning electrodes on one of substrate, an array of signal electrodes on other substrate, and liquid crystal cells between the ~~said~~ electrodes at their intersection points, the ~~said~~ cells generating display elements of the display, ~~characterized in that~~ wherein

the display elements are made having the value of display parameter N_{max} greater or equal number N_{maxo}, where N_{maxo} is greater number N and N_{maxo} is the minimum value of N_{max} of

a display capable to correct driving by voltage waveforms in accordance with the method ~~variants of claims from 1 to 16, realized separately or in their combination~~ of claim 1.